BIO RESCUE

BIOrescue:
A novel biorefinery concept for mushroom compost

www.biorescue.eu

CREATING VALUE FROM AGRICULTURAL RESIDUES: THE BIOREFINERY PROCESS STEP BY STEP

Inés del Campo, CENER

TOWARDS A CIRCULAR BIOECONOMY IN SPANISH INDUSTRY. 11 OCTOBER. MADRID.

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 720708

BIO-BASED INDUSTRIES Public-Private Partnership

Bio-based Industries Consortium

Horizon 2020 European Union Funding for Research & Innovation

CHALLENGES

Each year, over **3 million tonnes of mushroom compost** is generated by mushroom production, thus creating **significant economic and logistical problems** for Europe's farmers.

- Mushroom compost, prepared solely for growing mushrooms, is only suitable for one to three harvests;
- The compost is currently disposed of, even though it contains valuable components;
- The mushroom industry lacks adapted technological solutions to upgrade this compost into valuable products

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OBJECTIVES

- To demonstrate an innovative and resource-efficient **biorefinery concept** for mushroom compost conversion;
- **To create valuable bio-based products** from mushroom compost and other lignocellulosic feedstocks;
- To achieve a **20% overall cost-reduction** in the enzymatic hydrolysis process;
- **To reduce disposal costs** for mushroom compost and generate a new income stream for mushroom producers.

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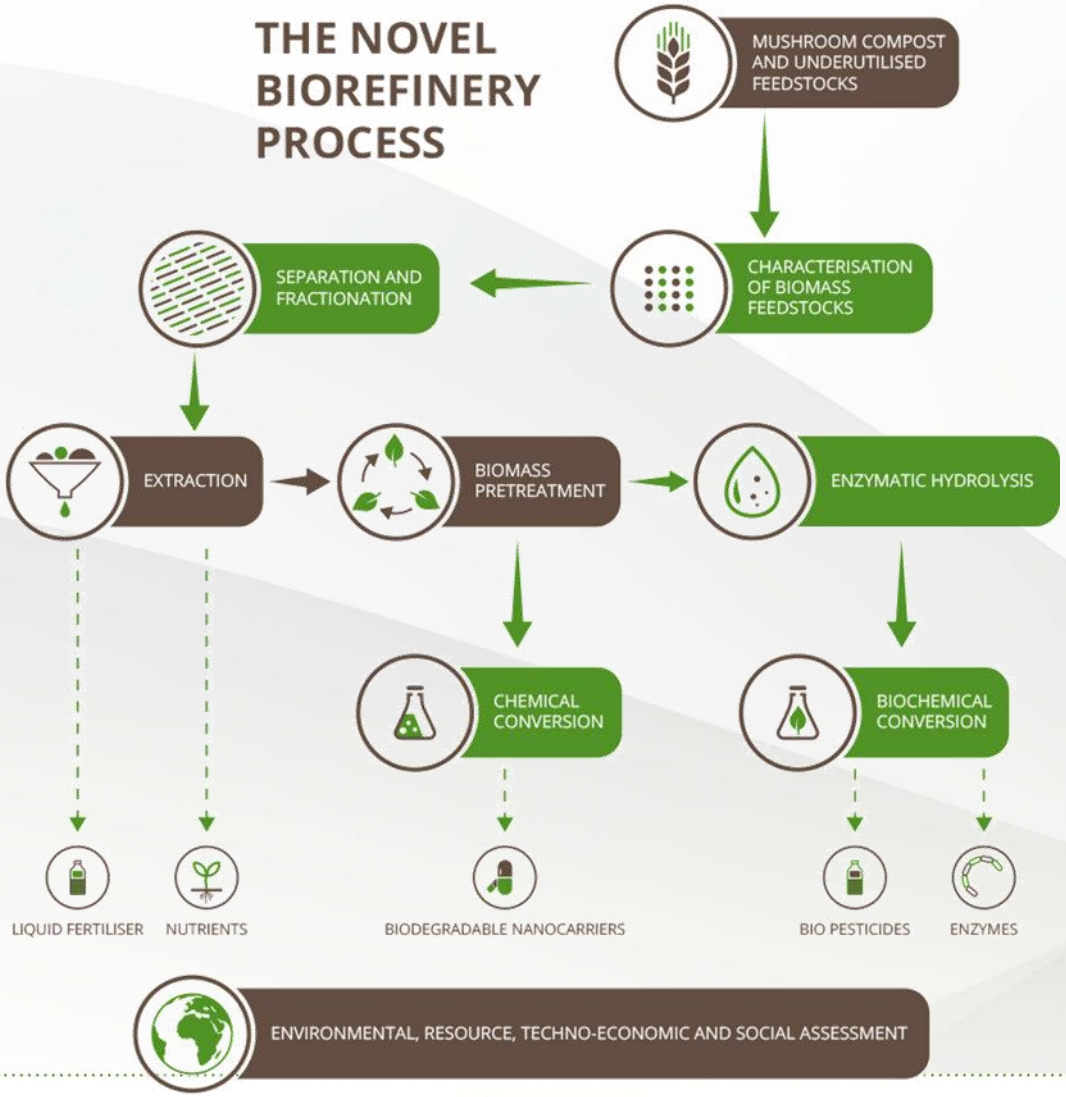

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BASE CASE STUDY: MUSHROOM PRODUCTION FARM

CHICKEN MANURE/ PEAT/ WHEAT STRAW

FRESH SUBSTRATE

MUSHROOM PRODUCTION FARM

SMS

MUSHROOMS

- *Compost only suitable for one to three harvests;*
- *Currently disposed of at high cost;*
- *The mushroom industry lacks adapted technological solutions to upgrade this compost into valuable products*

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BIOrescue CASE STUDY: BIOREFINERY FROM SMS AND UF

SMS

WS/UF

ENZYMES

ORGANOSOLV

TC PRETREATMENT

SEPARATION

SEPARATION

ENZYMATIC HYDROLYSIS SOLID FRACTION

SECONDARY CONVERSION LIQUID FRACTION

SEPARATION

NANOCARRIERS

BIOPESTICIDE FERMENTATION

ENZYME PRODUCTION

BIOPESTICIDE

ENZYMES

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WP1. Project coordination & Management

CENER | NATIONAL RENEWABLE ENERGY CENTRE
ADItech

zabala innovation consulting

WP7. Dissemination & Exploitation of results

Greenovate! EUROPE

C-Tech INNOVATION

WP4. Primary conversion

METGEN

MONAGHAN MUSHROOMS

Università degli Studi di Napoli Federico II

WP5. Secondary conversion

Max-Planck-Institut für Polymerforschung
Max Planck Institute for Polymer Research

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ADItech

METGEN

WP2. Supply, cultivation & assessment

MONAGHAN MUSHROOMS

Celignis Analytical

WP3. Fractionation & Separation

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ADItech

MONAGHAN MUSHROOMS

WP6. Environmental, resource, techno-economic and social impact assessment

Imperial College London

MONAGHAN MUSHROOMS

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C-Tech INNOVATION

Celignis Analytical

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THE NOVEL BIOREFINERY PROCESS

1. **Characterisation of biomass feedstocks**
2. **Separation and fractionation**
   a) Extraction
   b) Biomass pretreatment
3. **Enzymatic hydrolysis**
4. **Chemical and biochemical conversion**
5. **Environmental, resource, techno-economic and social assessment**

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THE NOVEL BIOREFINERY PROCESS

1. Characterisation of biomass feedstocks (WP2)

- Analysis of the composition of mushroom compost;
- Assessment of the availability of other underutilised agricultural feedstocks in mushroom producing regions;
- Development of rapid methods for real-time evaluation of biomass feedstocks.

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THE NOVEL BIOREFINERY PROCESS

2. Separation and fractionation (WP3)

Innovative two-step fractionation process for mushroom compost.

a) Extraction

Novel methodology for the extraction of high added value components.

b) Biomass pretreatment

Optimisation of the thermochemical pretreatment process for mixtures of mushroom compost and wheat straw or other underutilised agricultural feedstocks.

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THE NOVEL BIOREFINERY PROCESS

3. Primary conversion - Enzymatic hydrolysis (WP4)

Innovative enzymatic hydrolysis process including enzyme immobilisation and recycling:

- Improved enzymes for biomass conversion;
- Shorter hydrolysis times;
- Increased resource and cost efficiency.

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THE NOVEL BIOREFINERY PROCESS

4. Secondary conversion: Chemical and biochemical conversion (WP5)

- **Chemical conversion**: Innovative concept for the conversion of soluble lignin and other organic compounds into nanocarriers.
- **Biochemical conversion**: More efficient biochemical conversion process via enzyme improvement, immobilisation and recovery.

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THE NOVEL BIOREFINERY PROCESS

5. Environmental, resource, techno-economic and social assessment (WP6)

- Environmental evaluation for new bio-based products and processes
- Techno economic assessment to determine costs and benefits of individual process chain
- Sustainability integration of all issues to describe the most sustainable pathways among the value chains compared to all reference systems.

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PROJECT INFORMATION

- 10 partners from 7 different countries
- Duration: 3 years (September 2016-August 2019)
- Coordinated by CENER with the support of Monaghan Mushrooms as Technical Coordinator
- Co-funded by the Bio-Based Industries Joint Undertaking

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